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Brain injury is a leading cause of death and disability in children. Recent advances in pediatric magnetic resonance imaging (MRI) techniques are revolutionizing our understanding of brain injury, its potential for recovery, and demonstrating enormous potential for advancing the field of neuroprotection. We have created a highly structured, collaborative, and multidisciplinary training program in **BRAIN** (**B**rain **R**esearch **A**dvanced **I**maging with **N**MR) to advance research skills of investigators from all branches of the US military focusing on pediatric brain injury. Our goal is to train, with the highest rigor, military trainees in conducting clinical research using advanced brain imaging technologies to study the causes and consequences of pediatric brain injury. Over the past year, we successfully our online learning management system, by creating and implementing methods for converting the existing in-classroom educational BRAIN seminars into self-directed online learning modules and courseware. Specifically, we developed a web-based portal site located at www.MilitaryMedED.com and completed 14 e-learning BRAIN modules and conducted internal field testing of our BRAIN courseware for learning effectiveness among military and civilian trainees.

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INTRODUCTION

This report documents the activities conducted between September 2014 – September 2015 for the "Advanced Pediatric Brain Imaging Research and Training Program" project. The overarching goal of this grant is to advance the training of military clinician scientists in the field of investigative brain imaging technologies to understand the causes of brain injury and the mechanisms underlying brain plasticity following injury. In this annual report, we describe the development of a web-based BRAIN (**B**rain **R**esearch **A**dvanced **I**maging with **N**uclear Magnetic Resonance) training courseware which is housed at www.MilitaryMedED.com. Specifically, we summarize the development of the online e-learning BRAIN modules we have developed with our Subject Matter Experts, and the results of the internal field testing performed on both military and civilian trainees. To date, the survey data from the in-person lectures and online assessment scores demonstrate that both in-classroom and web-based approaches to teaching topics within the BRAIN program has significant training benefits for healthcare providers across multiple specialties and subspecialties.

BODY

The focus of our BRAIN training program over the past year was to transform our in-classroom BRAIN seminars into self-directed online courseware. The overarching goals of the BRAIN program focus on developing (i) the scientific rigor necessary to perform high-quality clinical research through instruction in epidemiology and biostatistics, (ii) an in-depth understanding of the underlying pathogenetic mechanisms of injury to the brain and its recovery, and (iii) the necessary skills to apply advanced MRI techniques to study brain injury, and to facilitate the diagnosis, management, and ultimately treatment of brain injury. We achieved the following milestones:

- Enhanced and maintained the web-based learning management system that houses the BRAIN online courseware (Appendix A)
  - Implemented the graphical user interface and mobile client for the web-based learning management portal system. The site is located at www.MilitaryMedED.com (username: test, password: Demo@123 – The "D" is capitalized. The site can be accessed from any device web browser (personal computer, tablet or phone) and operating system (*e.g. Windows, OS X, Linux, etc.*).
  - Developed nine new and enhanced the six initial e-learning modules *(15 total)* into SCORM-compliant online training modules on the fundamentals of MRI and fetal development. SMEs converted their PowerPoint presentations by storyboarding their content for instructional technologists and multimedia developers to begin producing interactive learning objects and assessments.

- Held ongoing internal workshops to teach SMEs and Co-PIs how to design, develop, and implement online BRAIN courseware training modules 7-15 (see Table 2).

- Performed field testing of the learning management system and six online BRAIN seminar courses.
  - Conducted field tests at Children's National Medical Center's main campus. There were 44 total field testers, 14 of which were military trainees and the remainder were civilian trainees. The average rating for how beneficial the web-based instructional content was to their learning showed a combined average of 3.76 on a scale of 5 (*1=No improvement to 5=Exceptional improvement*).

Our external advisory committee came to Children's National for a site visit on July 7th, 2014 at which time we provided a detailed update and demonstration of the on-line BRAIN courseware we have been developing to date. The committee members were very impressed by the web-based BRAIN educational platform we created and shared a unified enthusiasm

about our accomplishments (Appendix B). Below, we present a detailed summary of our progress with the e-learning modules to date.

Statement of Work: Progress to Date

Specific Aim 1: To advance the understanding of the fundamental principles and clinical application of sophisticated MRI techniques that is revolutionizing clinical research into the causes, consequences and care of pediatric brain injury.

Over the past year, the PI together with Ben Scalise (multimedia developer) and Jeff Sestokas (instructional designer) worked closely with the SME to develop e-learning courseware on the fundamental principles and applications of advanced MRI techniques. Over 40 military and civilian trainees came through our radiology program and participated in our BRAIN e-learning module field testing. The disciplines that were represented included fetal medicine, neonatology, neurology, critical care medicine, radiology, biomedical engineering, nursing, psychiatry and psychology. We have created 10 modules that provide integrated teaching on introduction to MRI, MRI safety, the fundamentals of digital imaging, Pediatric MRI without sedation (challenges and opportunities) and courseware on specific neuroimaging modalities including cerebral perfusion imaging, diffusion weighted/tensor imaging, functional MRI, and magnetic resonance spectroscopy. A detailed update on our progress on the e-learning module development is summarized in Section A: E-Module Training Design/Development.

Specific Aim 2: To enhance knowledge through the didactic and clinical teaching of the basic science and clinical understanding of the causes, mechanisms, and consequences of pediatric brain injury.

We have developed five comprehensive e-learning modules on the principles of pediatric brain injury that capture a wide scope of themes in pediatric brain injury including normal and abnormal brain development, mechanisms of acquired brain injury (including traumatic brain injury and hypoxic-ischemic injury), with a direct link made with the role of advanced brain imaging techniques (*Specific Aim 1*) in facilitating diagnosis, management and rehabilitation as well as plasticity following brain injury. Our progress in transitioning these seminars to web-based e-learning modules is detailed in Section A: E-Module Training Design/Development.

Specific Aim 3: To provide training in clinical research methodology through courses and seminars in biostatistics and research design, and responsible conduct of clinical investigation.

For our e-learning BRAIN modules we have consolidated our on-line <u>FACTS</u> (Focus on Clinical and Translational Science) curriculum with extensive resources (*archived lectures, tutorials, publications*) covering central research thematic areas including study design, developing goals and objectives, research implementation, statistical analyses, sources of error, etc.

A. E-Module Training Design/Development

A Continuous Design Phase (Training Modules 1-15)

During this year's design phase, we transformed nine selected PowerPoint presentations into Shareable Content Object Reference Model (SCORM) compliant web-based training modules (Table 2; modules 7-15). We also refined the first six modules we created in the prior year based on the feedback and results from our internal field testing (described below). As with the first six training modules, we used the same five-stage design approach that incorporates learning objectives, learner abilities, instructional methods, module content, and assessment methods into the training delivery (Table 1).

Table 1*. The Five-Stage Design Approach* of the online BRAIN curriculum

Design Requirements	Description
1. Scaffold Knowledge with Learning Objectives	Organize knowledge and skill components for each instructional module scene in a sequence from basic to complex units of learning.
2. Learner's Abilities	Account for the learner's prior knowledge and skill development.
3. Instructional Methods	Establish the approach for presenting the lesson content.
4. Module Content	Focus on the pediatric brain and MRI fundamental concepts and ideas that a medical provider would need to know.
5. Assessment Methods	Provide knowledge checks before, during or after user engagement with the lesson content. Assessment methods include true and false, multiple choice, multiple response, fill in the blank, drag and drop, and essay.

New Training Module Overview

Module 7 provides an overview tutorial of the Tortoise software program which is a well-known diffusion MRI software processing package developed by the National Institutes of Health. Modules 8 and 9 provide detailed training of the inner workings of MRI safety including medical and support devices, the use of metal objects in the MRI environment, floor plan zones and

signage, acoustic, cryogenic, and electrical hazards, and emergency response and shutdown protocols. Modules 10 and 11 provide education and training on the mechanisms and neuropsychological effects of Traumatic Brain Injury (TBI), including brain development, risk-factors, consequences and outcomes following TBI. Module 12 helps learners understand the basics and process of how diffusion is measured with MRI along with explanations of how directional information of water movement can be extracted and interpreted in the setting of brain disorders and brain injury. Module 13 provides an overview of the processing steps for robust diffusion MRI data, the effects within each step of the outcome, and any resulting effects in analysis. Module 14 discusses the basics of perfusion and non-MR perfusion imaging with or without contrast agents and arterial spin labeling, along with clinical applications. Finally, module 15 walks learners through the concepts behind and clinical application of magnetic resonance spectroscopy including how to interpret NMR Spectra (electron shielding, spin spin coupling, field linearity, and sample chemical composition), nuances of Lorentzian Function and Line shape, signal to noise, and brain chemical sin 1H & 31P NMR as well as new research in NMR Spectra for DTI acquisition and procession and gray matter tissue segmentation.

Table 2. *Online Training Modules for the BRAIN program (Appendix C)*

Module Title	Learning Objectives
PEDIATRIC BRAIN DEVELOPMENT	
Module #1: Corpus callosum and other major commissures: anatomy, normal and abnormal development (Dr. Gilbert Vezina)	• Discuss the corpus callosum and other major cerebral commissures looking at their anatomy through the lens of normal and abnormal development. • Understand why a full radiologic assessment is necessary to properly categorize a case of abnormal corpus callosum. • Understand the basis of the abnormal corpus callosum development and its genetic and clinical implications.
Module #2: Normal and abnormal development of the cerebellum (*Dr. Adre Du Plessis*)	Review the cerebellar anlagen • Flexing of the rostral neural tube • Defining fundamental territories • Mesenchymal-neuroepithelial signaling Describe cerebellar hemispheres and vermis • Cellular proliferation

	• Cellular migration • Cellular differentiation • Neural organization
Module #3: Investigating brain plasticity and connectivity with structural MRI techniques (Cibu Thomas)	• Review the concept of brain plasticity • Describe how MRI can be used to measure changes in brain structure due to plasticity • Review the limitations of prevailing MRI studies on structural plasticity and how one can circumvent the limitations
MRI FUNDAMENTALS	
Module #4: Introduction to MRI (Dr. Iordanis Evangelou)	• Review basic magnetic resonance or MR physics • Describe the origins of the MR signal • Discuss the concept of protons, spin, the Larmor equation • Review precession and how the MR signal is formed from longitudinal to transverse magnetization
Module #5: Fundamentals of Digital imaging (Dr. Ahmed Serag)	• Discuss the fundamentals of digital images and multidimensional data • Review medical imaging and their modalities
Module #6: Pediatric MRI without sedation: Is it the art or science? (Dr. Raymond Sze)	• Review the role of a Certified Child Life Specialist • Summarize the key components of a successful pediatric non-sedate MRI program • Identify ideal candidates for attempting a non-sedate scan • Describe three major benefits of creating and implementing a pediatric non-sedate MRI program
Newly Developed Training Modules	
Module #7: Tortoise Software Tutorial (Dr. Okan Irfanoglu)	• How to use the TORTOISE Diffusion MRI Processing Package • What can be accomplished with TORTOISE Diffusion MRI Processing Package

Module #8: MRI Safety Part I (Dr. Stanley Fricke)	• MRI Suite Floor Plan • Medical Devices, Implanted or Support Devices, Various types of Metal in the MRI Environment.
Module #9: MRI Safety Part II (Dr. Stanley Fricke)	• MRI Suite Zones and Signs • Understanding Acoustic, Cryogenic & Electrical Hazards • Emergency Response & Magnet Shutdown Procedure
Module #10 TBI Mechanisms (Dr. Gerry Gioia) **Module #11** TBI Neuropsychological Effects (Dr. Gerry Gioia)	• Define Traumatic Brain Injury and its Mechanisms • Describing Neuroimaging features • Describe Neuropsychological Outcomes Following Brain Injury • Examining imaging-clinical correlates
Module #12: Introduction to Diffusion Weighted Imaging (Dr. Joelle Sarlls)	• Understand the Process of Diffusion • Know the Basics of how Diffusion is Measured in MRI • How Directional Information of Water Movement can be Extracted
Module #13: DTI Processing Software Overview (Dr. Okan Irfanoglu)	• Processing steps for Robust Diffusion MRI data based analysis • Determine the effects within each step of the Outcome • Determine if processing software selection has affected an analysis
Module #14: Introduction to Perfusion Imaging (Dr. Wesley Zun)	• Basics of Perfusion • Non-MR perfusion Imaging • MR Perfusion Imaging with Contrast Agents • MRI Perfusion Imaging without Contrast Agents & Arterial Spin Labeling

Module #15: Introduction to Magnetic Resonance Spectroscopy (Dr. Stanley Fricke)	• How to Interpret NMR Spectra
	  - Electron Shielding
	  - Spin Spin Coupling
	  - Field Linearity
	  - Sample Chemical Composition
	
	• Discuss Facts and Fiction
	  - Lorentzian Function and Line Shape
	  - Signal to Noise

	- Brain Chemicals in 1H & 31P NMR
	
	• Research Directions in NMR Spectra
	  - DTI Acquisition and Processing
	  - Gray Matter Tissue Segmentation

Novel Visual Enhancements

As described in last year's annual report, we continued to create and implement multimedia objects (*e.g., graphics, audio, animations*) throughout module scenes to assist learners in the visualization of new knowledge and concepts. For example, in module 10 scene 8, a multimedia object containing layered graphical element illustrates the process of brain jury and its resulting effects. As the speaker narrates the scene, the multimedia object illustrates a timeline of events for mild traumatic brain injury describing the pre-injury risks through post-concussion symptoms (Figure 1). The animations were created not just to convey instructional points, but to promote active engagement and to immerse learners by conveying a realistic medical situation and series of events. The text elements, interactive and composite still graphics were used to accommodate the visual learner while the audio narration supports the auditory learner.
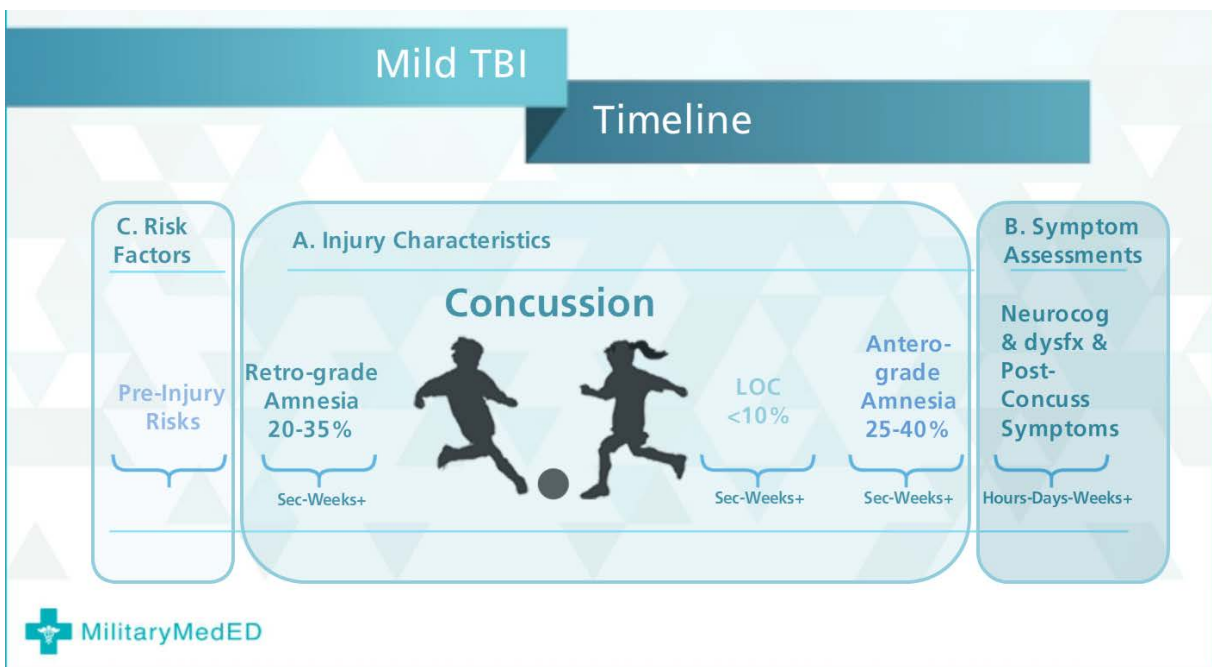

Figure1. Novel Animation Example

Training Module Player Requirements

As in the case of training modules 1-6, the visual elements presented in modules 7-15 use a variety of graphical elements such as:

- A slide title shown at the beginning of the module
- Multiple levels of bulleted text.
- Still composite graphics
- Custom animations such as animated diagrams or illustrations with text or image fade-ins
- The training modules are BEST viewed using the latest Adobe Flash plugin, which provides a screen visibility of the animated content. For operational purposes, the screens were designed to have a resolution of 1280 x 1024 and 1024 x 768.

B. Knowledge Assessments

Pre and post assessment were developed and implemented for the pilot training modules 1-6 (Appendix D). In addition to the pre and post assessment data, we gathered participant feedback using a post-run module questionnaire accessible from inside the training portal. The post-run module questionnaire depicts information pertaining to perceived improvement of the module learning objectives, usability, organization and challenging/engaging the nature of the instructional content as well as open-ended responses on what they liked and didn't like about the module, and recommendations for future module development.

Internal Field Testing: Test Pre and Post Assessment Summary

We performed several field tests with the first six online training modules. The field tests were facilitated by Ben Scalise. Forty-four trainees had an average of 5.8 years of medical experience. The mean score for how beneficial the web-based BRAIN courseware was to their learning was 3.76 on a scale of 5 (*1=No improvement to 5=Exceptional improvement*). Trainees' scores improved 29.5% from their pre to post assessment scores (*combined pretest AVG =64.5% to combined post-test AVG=94.04%*). The scores demonstrate that online multimedia learning provides a highly engaging educational method to teaching complicated topics about the developing pediatric brain and MRI techniques.

This field test(s) included a (pre/post: pre-test vs. post-test) mixed design, with training being a between-subjects factor. We randomly assigned participants to the training condition of different brain seminar topics:

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Group A	Group B
• **Investigating Brain Plasticity and Connectivity with Structural MRI Techniques** (N=12) Overall Average | **Pre-Test** 66.6 **Post Test** 100 • **Intro to MRI** (N=18) Overall Average | **Pre-Test** 75.5 **Post Test** 97.7 • **Normal/Abnormal Development of the Cerebellum** (N=13) Overall Average | **Pre-Test** 38.5 **Post Test** 86.15	• **Fundamentals of Digital Imaging** (N=14) Overall Average | **Pre-Test** 77.1 **Post Test** 95.7 • **Pediatric MRI Without Sedation** (N=15) Overall Average | **Pre-Test** 52.3 **Post Test** 86.7 • **Corpus Callosum and other Major Commissures** (N=10) Overall Average | **Pre-Test** 50% **Post Test** 98.0%

The next section focuses on discussing the post-module survey results in which participants documented their reactions concerning improvement of stated learning objectives, content relevancy, and recommendations and improvements for future module development. A full summary of our procedure, analysis, and discussion of training effectiveness data will be disseminated in the annual report upon completion of all proposed field tests.

Field Test Post-Run Questionnaire Summary

At the end of each field test, participants were given summative evaluations to rate their reactions to intended learning objectives, realism of the content, user experience, and future recommendations and improvement areas to the training modules. Additionally, participants rated their reaction responses to general expectations for the interactive training, and whether or not the instructional products should be incorporated for use in clinical professional development, and which areas users liked best and least about using the modules.

The primary questions considered in the evaluation were:

- What are the participant's feelings and attitudes towards achievement of critical learning objectives during the training module?
- Did the training module present relevant content that could be applied in real-world medical situations?
- Did the training module content teach participants about the pediatric brain or MRI that they previously did not know?
- Will the participant apply the knowledge learning in the training module while practicing at their institution and use other resources and activities housed in the MilitaryMedED.com platform in the future?

The first set of questions measured participant reaction responses on intended learning objectives for the training module. Additionally, the second set of questions measured participant reaction responses on the relevancy of the training content, their user experience, and recommendations for improving and developing new content. Finally, the third set of questions measured participant reaction responses to general expectations for the interactive training, whether or not the content and platform should be incorporated for use in clinician professional development, and areas users liked best and least about using the activities and resources.

Questionnaire Results

At the conclusion of the first field test, participants were asked to rate their progress on three to five tailored learning objectives intended for the training module content using a one-to-five Likert scale to measure their improvement on BRAIN seminar topics (1 = no improvement, 5 = exceptional improvement). Learning objectives included the ability of participants to understand key concepts of the brain and MRI, define function and terminology, reflect and discuss critical ideas presented throughout the module. Overall, participants felt they made above average progress on understanding the intended learning objectives (combined mean = 3.76, SD = 0.28). Moreover, participants evaluated not only intended learning objectives for the training modules, but also provided both written and numeric feedback rating and summarizing their feelings and attitudes on the general relevancy and content presentation. Participants indicated they felt strongly that the training modules presented relevant content that could be applied to real-world medical situations (combined mean=3.81, SD = 0.31), taught information about the pediatric brain and MRI that they previously did not know (combined mean=3.71, SD=0.57), provided a better understanding about the topics or ideas discussed in the module (combined mean=3.88, SD=0.31), felt that they will apply the learned techniques at their institution (combined mean= 3.51, SD=0.21), and finally will participate in the future using other BRAIN training modules and the learning management platform (combined mean=3.68, SD=0.29).

C. BRAIN E-module Military Implementation Plan: Next Steps

In the current year, our plan was to begin to disseminate the BRAIN courseware to military bases in the latter part of the 4th year, we elected to incorporate the feedback we received from the 44 trainees in the spring to refine and optimize the existing 15 BRAIN modules. Over the next year, we plan to introduce the BRAIN e-modules to top medical military residency

programs as a tool for providing distance learning and training on advanced neuroimaging technologies to study and understanding pediatric brain injury and recovery following injury. We will showcase our BRAIN courseware to key military educational stake holders in order to demonstrate the value of this educational tool as a modality for saving time and training costs, improving clinical performance, and providing quality training experiences. To gain access to the identified military residency programs, we will seek endorsement from the U.S. Army Medical Research and Materiel Command in order to provide credibility and acceptance to the site, and help accomplish the project's objectives for creating innovative medical education on emerging medical areas such as pediatric brain development. We will seek organizational buy-in and implement the training portal as follows. In order to familiarize the target audiences at the military bases with the tool's capacities, we will set-up meetings and demonstrate MilitaryMedED.com's training tool at military medical bases. Table 4 provides an example of applicable ACGME military residency program for MilitaryMedEd.com training. We will also create and implement outreach activities e.g., online or in-person peer exchanges, training workshops, and stakeholder meetings to maintain awareness of MilitaryMedEd.com training portal. We will specifically target military bases with a pediatric unit and conduct external learning effectiveness experiments. We will develop additional training content and modules based on our data results and offer refresher workshops as needed. We will provide ongoing technical and training support to assist military users in problems or challenges that may arise when operating the software by setting up a dedicated support email address (help@militarymeded.com) and a dedicated technical support phone number, in addition to having users use the helpdesk plugin integrated in the system. We will also create users guides that illustrate best practices and new features of the tool.

Table 4. Applicable ACGME Military Residency Programs for Training Housed on MilitaryMedED.com

Air Force Residencies (* Washington DC locations will be Walter Reed)			
Specialty	*Sponsoring Military Base*	*Potential # of Participants*	*Years in Program*
Neurology	Lackland San Antonio, Tx	2	Internship within 4 years
Radiology	Lackland San Antonio, Tx	5	Internship within 4 years
Radiology	Travis AFB, Fairfield, CA	5	Internship within 4 years
Radiology	Bolling/Andrews, DC	3	Internship within 4 years

Army Residency Programs			
Specialty	*Sponsoring Military Base*	*Potential # of Participants*	*Years in Program*
Neurology	Ft. McNair, DC	3	NA
Neurology	Joint Base Lewis-McChord, Washington	3	NA
Neurosurgery	Ft. McNair, DC	12 (6 military and 6 civilian sponsored)	NA
Radiology	Ft. McNair, DC	4	NA
Radiology	Ft. Sam Houston, San Antonio	4	NA
Radiology	Joint Base Lewis-McChord, Washington	4	NA
Navy Residency Programs			
Specialty	*Sponsoring Military Base*	*Potential # of Participants*	*Years in Program*
Neurology	National Naval Medical Center, Bethesda MD	2	Internship within 3 years
Neurosurgery	National Naval Medical Center, Bethesda MD	1	Internship within 6 years
Radiology	National Naval Medical Center, Bethesda MD	4	Internship within 4 years
Radiology	Naval Medical Center, Portsmouth, VA	5	Internship within 4 years
Radiology	Naval Medical Center, San Diego, CA	6	Internship within 4 years
Totals	15 programs	63 potential participants	

D. Future Activities

For the next 12 months, we plan to complete the following:

- Finalize the remaining storyboards that need to be converted from in-classroom lectures to e-learning modules

- We will conduct field tests at Children's National Medical Center and targeted military medical facilities based on their expertise in pediatrics and/or neurology, radiology, traumatic brain injury and medical education activities.

-

- We will document, analyze and write initial military field test results using the Krikpatrick training effectiveness evaluations we have been using to date.

- We will continue to enhance the existing training content and develop additional training modules based on data results.

KEY RESEARCH ACCOMPLISHMENTS

Development and implementation of the web-based BRAIN curriculum

- Enhanced and maintained the web-based learning management system that houses the BRAIN online courseware at www.MilitaryMedED.com
  - The site can now be accessed from any device web browser and operating system

- Developed, optimized and uploaded 15 SCORM-compliant online training modules

- Refined our on line FACTS (Focus on Clinical and Translational Science) curriculum onto our portal site.

- Held ongoing internal workshops to teach co-investigators and SMEs how to design, develop, and implement online BRAIN courseware training modules

- Performed field testing of the learning management system and six online BRAIN seminar courses which lead to further improvements on the BRAIN courseware modules.

REPORTABLE OUTCOMES

- Jeff Sestokas presented a workshop at the Pediatric Academic Societies Meeting (2015). "Multimedia Learning: Selecting The Right Educational Technology For Your Learners," where the MilitaryMedED.com BRAIN courseware was featured.

- Jeff Sestokas presented a workshop at the Society of Pediatric Radiology (2014): "The Expert Clinician: Transformative Online Education to Accelerate the Professional Development of Today's Medical Professionals," where our BRAIN e-learning modules were highlighted.

CONCLUSION

Over the past year, we developed and enhanced 15 BRAIN e-learning modules and refined our on online learning management system. Our initial internal field testing results on 44 military and civilian trainees demonstrated the effectiveness and responsiveness of our novel e-learning instructional BRAIN courses. Activities in the coming year will include finalizing our remaining in-classroom seminars to e-learning module conversions, introducing our BRAIN e-seminars to local and national military bases, and ongoing field testing for module refinement and optimization.

APPENDICES

Appendix A   Enhancements to web-based learning management system

Appendix B   DoD site visit report

Appendix C   Storyboard procedure and template

Appendix D   Pre and post knowledge assessment questions

APPENDIX A:
ENHANCEMENTS TO WEB-BASED LEARNING MANAGEMENT SYSTEM
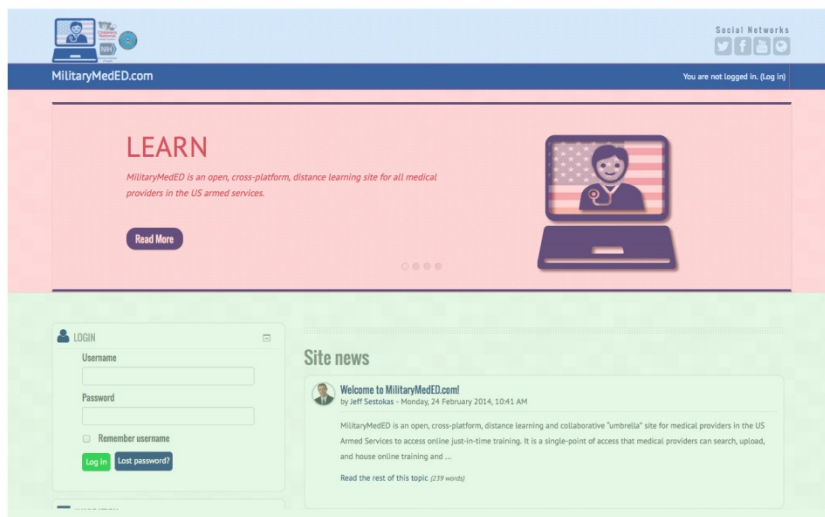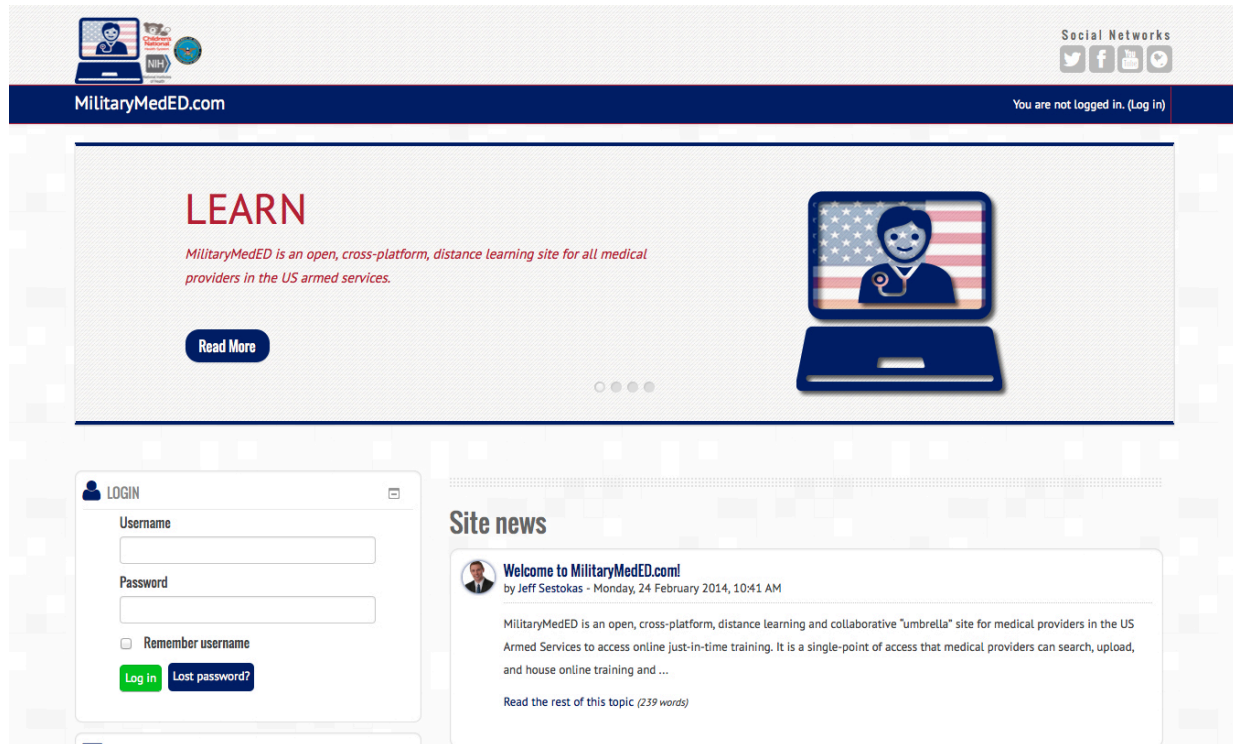
Modify Header and Navigation

Simplify Banner

Unify Branding

July 15, 2015

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Dear Catherine,

The following is the report regarding the site visit of by the External Advisory Board for your Department of Defense (DoD) training grant entitled "Advanced Pediatric Brain Imaging Research Training Program (W81XWH-11-2-0198)", which met on July 7, 2015. The board members consist of myself and Drs. Michael V. Johnston and Ashok Panigrahy.

Our uniform consensus is that you have done an excellent job in the development of the MilitaryMedEd portal that incorporates at least 11 modules that are directly related to the objectives of the Brain Research Advanced Imaging with Nuclear Magnetic Resonance (BRAIN) initiative. These include introductory topics such as an Introduction to MRI and MRI Safety, and up to detailed instruction on the use of the TORTOISE software for processing of diffusion tensor imaging (DTI) for research.
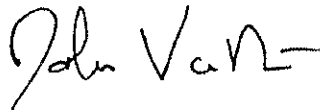
The MilitaryMedEd portal is fulfilling the BRAIN initiative's mission for the DoD by providing trainees with access to the latest imaging techniques in pediatric brain injury, clinical research, and translation of these techniques to the bedside. The training program is comprehensive and incorporates experts from both Children's National Medical Center and National Institutes of Health. The topics covered in your program include diffusion tensor imaging (DTI), MR spectroscopy (MRS), morphological analyses such as voxel-based morphometry (VBM), and functional MRI (fMRI). The success of this portal will allow future trainees regardless of where they are located to get the instruction needed to learn how to use and apply these techniques.

The educational format of the MilitaryMedEd portal has been tested by 24 trainees, who provided feedback on the ease of use and utility of the portal. Their average ratings of the how well the portal worked and was beneficial was a combined average of 3.82 on a scale for 1 to 5 (1=No improvement to 5=Exceptional improvement). In addition, these trainees' scores improved 29% on average from their pre- to post-training. Combined
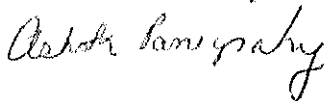
these data amply demonstrate that the portal and it's training format provide an engaging and beneficial way to provide online learning of very highly complicated topics.

In summary, we commend you for creating an excellent program providing training in the latest neuroimaging research techniques along with the essential methodologies for conducting clinical research including basics such study design and statistics. We also feel that the MilitaryMedEd platform exceeds the objectives of the BRAIN initiative by providing military physicians with instruction on the neuroimaging techniques, which will continue to expand over time.

Sincerely,

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APPENDIX C:

STORYBOARD PROCEDURE & TEMPLATE

I *Objectives*
- List 2-3 Objectives from presentation
- Remove any content from presentation not relevant to objectives
- View an example of a slide translated into a Storyboard [*see page4*]

II Narrative
- Condense & Bullet Point Main Dialog from Objectives
- Provide Script for Voice Over [*see page6*]

III *Assessment Questions*
- Create 3-5 assessment questions from Objectives [*see page5*]

Assessment Question Options:

a. Create Assessment Questions throughout the body (preferred with or without Post-Test)
b. Create Post-Test only
c. Create Post-Test with Assessment Questions throughout the body

*** *This information can be delivered either via Storyboard Template as subsequently provided or in the Notes Section of your PowerPoint presentation slides.***

This will assist in creating the 3 main sections of the Module. See **link** for example.
[http://www.childrensmedicaleducation.org/cbt/complex/mod1/story.html]

1. *Intro*
   a. Home
   b. Welcome
   c. Learning Objectives Briefing

2. *Body* (note that the Assessment Questions can be interspersed throughout the body as shown in this example and/or included as a Post Test at the end of the 2-3 Objectives)
   a. Objective1
      i. Assessment Question
      ii. Assessment Question

   b. Objective2
      i. Assessment Question
   c. Objective3
      i. Assessment Question
      ii. Assessment Question

       d. Post Test *(Optional to include with or without interspersed Assessment Questions)*
            i. Assessment Questions
3. *Summary*
      - Brief review of all content discussed
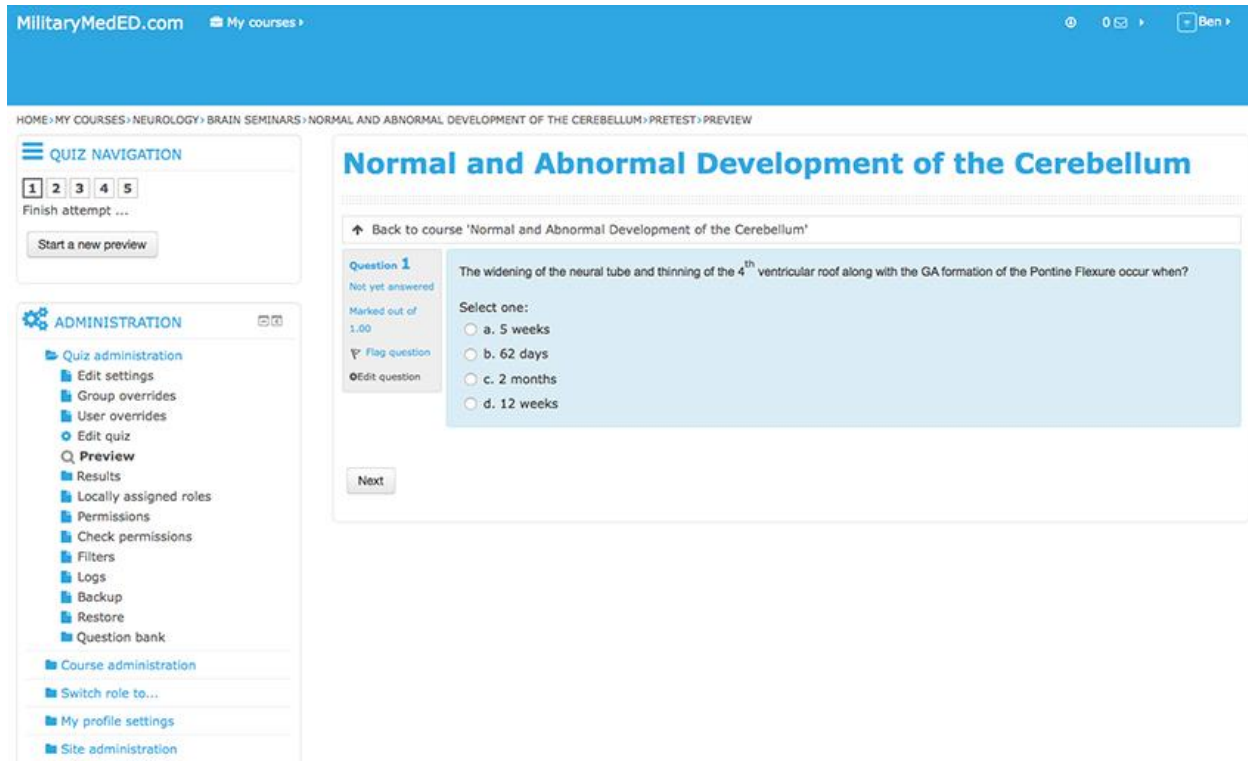
Online Learning Module Storyboard

Course:			
Module:			
Lesson:		1	
Segment:		1	
Page Title:		1	
Child Page:			
Objective:			

On-Screen Text:

Narration / Closed Captioning: Narrator

Graphics: (P – photo; G – graphic; F – flash animation; T – table/chart/graph; V – video)

Audio:

Knowledge Check:	**Remedial Screen:** *Page ID*
Correct Feedback:	
1st try incorrect:	
2nd try incorrect:	

Explanatory Information:

    Italics has no functional effect
    Bold is a rollover
    <u>Underscore</u> is a click to pop-up with click to close

Branching:	Back:	Next:

APPENDIX D:
PRE AND POST KNOWLEDGE ASSESSMENT QUESTIONS

MilitaryMedED.com   📚 My courses ›   ⊙   0 ✉ ›   ⊡Ben ›

Normal and Abnormal Development of the Cerebellum

QUIZ NAVIGATION

[1] [2] [3] [4] [5]

Finish attempt ...

Start a new preview

⚙ ADMINISTRATION

- 📂 Quiz administration
  - 📄 Edit settings
  - 📄 Group overrides
  - 📄 User overrides
  - ⚙ Edit quiz
  - 🔍 Preview
  - 📄 Results
  - 📄 Locally assigned roles
  - 📄 Permissions
  - 📄 Check permissions
  - 📄 Filters
  - 📄 Logs
  - 📄 Backup
  - 📄 Restore
  - 📁 Question bank
- 📁 Course administration
- 📁 Switch role to...
- 📁 My profile settings
- 📁 Site administration

↑ Back to course 'Normal and Abnormal Development of the Cerebellum'

Question 4
Not yet answered
Marked out of 1.00
🏴 Flag question
⊕Edit question

In what is the Foxc1 gene expressed?

Select one:
- ○ a. Mesenchyme
- ○ b. Subarachnoid Space
- ○ c. Neurocutaneous Melanosis

Next

MilitaryMedED.com   📚 My courses ›   ⊙   0 ✉ ›   ⊡Ben ›

⚙ ADMINISTRATION

- 📂 Quiz administration
  - 📄 Edit settings
  - 📄 Group overrides
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  - 📄 Filters
  - 📄 Logs
  - 📄 Backup
  - 📄 Restore
  - 📁 Question bank
- 📁 Course administration
- 📁 Switch role to...
- 📁 My profile settings
- 📁 Site administration

Normal and Abnormal Development of the Cerebellum

↑ Back to course 'Normal and Abnormal Development of the Cerebellum'

PreTest

Grading method: Highest grade

Attempts: 19

Summary of your previous attempts

Attempt	State	Marks / 5.00	Grade / 10.00
Preview	Finished Submitted Friday, 6 March 2015, 9:58 AM	5.00	10.00

Highest grade: 10.00 / 10.00.

Preview quiz now